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The Scale as a Factor Inducing Male's Copulation Attempt in the Potato Tuber Moth, *Phthorimaea operculella* (Lepidoptera : Gelechiidae)

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RIGHT:

最も感受性の低い小中島 (0.087 ppm) でも御所系の約3.9倍で抵抗性の発達は認められない。

Nankor の場合は小中島 (0.0646 ppm) が御所系の約5倍で耐性がついたものといえる。Dowco-214では各系統とも御所系と比較して約3倍程度強く、耐性がつきつつあるものといえる。この場合、Dowco-214が実際に使用されていないので交差耐性と考えられる。

以上、尼崎市内で採集された6系統の間の感受性の差異は殺虫剤によって異なるが、小中島はいずれの殺虫剤に対しても強く抵抗性系統といえる。また、南七松は尼崎市内では感受性系統といえる。また、南七松は1968年の調査結果と今回の結果のあいだには大きな変化がみられない。小中島は少々強くなる傾向がある。今後、小中島地域で殺虫剤の散布に際しては林、加納(1974)¹⁾が示唆した如く、殺虫剤散布前後に調査を行ない殺虫剤の選択を行なう必要があろう。

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Summary

The Pale house mosquitos were collected from 6 places in Amagasaki City, and their resistance levels to Dowco-214, Nankor, Baytex, diazinon, sumithion and DDVP were evaluated by WHO test method.

The LC_{50} values of 6 colonies of the pale house mosquitos collected in Amagasaki City are shown in Table 2 and may be divided into four groups as follows in descending order: 1) Dowco-214 2) Baytex, Nankor 3) sumithion, diazinon and 4) DDVP was most inferior to above chemicals. All colonies of the pale house mosquito larvae in Amagasaki City were resistant to Baytex. The LC_{50} values for Baytex of Minaminanatsumatsu (0.0347 ppm), Konakashima (0.0692 ppm) were higher than the value of the Gose strain (0.0036 ppm).

The Scale as a Factor Inducing Male's Copulation Attempt in the Potato Tuber Moth, *Phthorimaea operculella* (Lepidoptera: Gelechiidae). Tomohiro Ono (Laboratory of Applied Entomology and Nematology, Faculty of Agriculture, Nagoya University, Chikusa-ku, Nagoya, Japan) Received May 20, 1974. *Botyu-Kagaku*, 39, 93, 1974.

20. ジャガイモガの交尾行動における鱗粉の役割 小野知洋 (名古屋大学農学部害虫学教室, 名古屋千種区不老町) 49. 5. 20 受理

ジャガイモガの雄は、雌に対する以外にも交尾を試みることがある。そこで、この行動をひき起こす刺激はいかなるものであるのかについて、種々のモデルを用いて検討を行なった。その結果、鱗粉が重要な役割を演じていることが明らかとなり、その刺激の種類は、接触に伴う物理的な刺激と考えられた。

It is well known that many kinds of stimuli take part in successive chains of mating behavior in insects. Among others, there are the stimuli which induce in males the copulation trial with some object. In some insects, it was observed that pheromone-stimulated males attempted copulation by the visual stimuli even with clay or paper models^{1,2)}. The present experiment was carried out in order to find out what kind of stimuli act as a releaser for copulation attempt in male moth of the potato tuber moth, *Phthorimaea operculella*.

Experimental

The insects used were reared on potato tuber at 25°C and 16 hr photophase. The observations were held in glasshouse (160×160×220cm) ventilated constantly and controlled at 15 to 25°C under continuous light. Males of five days old were released into the glasshouse everyday to keep fifty or more males throughout the period of experiments.

In addition to the dried specimens of female and male moths of *P. operculella*, various kinds of models were prepared by using the rolled

filter papers (7 mm in length and 2 mm in diameter each, Toyo Roshi No.2). The models impregnated with 5 μ l of methylene chloride extract of female moths (40 female equivalents per ml) were also prepared. Four models of each type were fixed on a filter paper (15cm in diameter, Toyo Roshi No.2) in the posture similar to the calling female⁹⁾. They were arranged equidistantly in a square of 4cm in each side.

The ring made of cardboard (17cm in diameter and 3cm in width) as a stand for observations was hanged from the ceiling of the glasshouse at 1m in height. A filter paper, on which models were fixed, was placed on the stand, and a piece of filter paper (2 \times 2cm, Toyo Roshi No.2) impregnated with about 10 μ l of female extract was placed on the center of the filter paper to attract males. The behavior of males flying towards the filter paper was then observed.

The numbers of individuals which made one or more contacts and of those which made copulation attempt with various models are summarized in Table 1.

In case of dried specimens, males attempted copulation with both female and male models, but the percentage of such attempts in the number of contacts was higher with the former than with the latter. Such a difference may be due to the sex pheromone which still remained in dried female specimens in spite of drying treatment. Actually, the percentage was raised a little with male models when they were impregnated with female extract. On the other hand, the filter paper models did not induce copulation attempt even when they were impregnated with female extract. From these results, it is obvious that the sex pheromone is one of the factors promoting copulation attempt but not the only one. The following observations were, therefore, made by use of males to avoid the possible influence of sex pheromone.

It was found that the paper models stuck the fore wings of *P. operculella* with adhesive (a synthetic resin, Adhea Nori, Sekisui Jushi Co. Ltd.) had a similar effect as male models mentioned above. Moreover, the same effect was observed even when the paper models covered

Table 1. Response of male potato tuber moth *Phthorimaea operculella* against various models.

Models	No. of contacts (A)	No. of copulation attempts (B)	B/A (%)
dried ♀ <i>P. o.</i>	33	31	94
dried ♂ <i>P. o.</i>	52	27	52
dried ♂ <i>P. o.</i> impregnated with ♀ extract	37	25	68
rolled filter paper only	42	0	0
rolled filter paper impregnated with ♀ extract	29	1	3
rolled filter paper coated with adhesive	49	0	0
fore wings of ♂ <i>P. o.</i>	51	26	51
scales of ♂ <i>P. o.</i>	51	25	49
fore wings of ♂ <i>P. o.</i> without scales	52	15	29
powdered scales of ♂ <i>P. o.</i>	48	0	0
♂ <i>P. o.</i> scales kneaded with adhesive	30	0	0
♂ <i>P. o.</i> scales washed by acetone and chloroform	54	28	52
scales of <i>C. c.</i>	42	24	57
scales of <i>C. s.</i>	43	26	60

P. o.: *Phthorimaea operculella*

C. c.: *Cadra cautella*

C. s.: *Chilo suppressalis*

with the scales detached from wing were provided. From these observations, it was suggested that the scale played some important role in evoking the copulation attempt. When using the paper models stuck the fore wings from which almost all scales were removed, the percentage of copulation attempts was fallen significantly ($P < 0.05$).

Then, what kind of stimulus of scales induce copulation attempt? For the purpose of finding it, several kinds of models were prepared. Those include the paper models covered with scales of *P. operculella* which were homogenized with distilled water in a glass homogenizer (powdered scales) and those coated with colorless adhesive which contained scales (scales kneaded with adhesive). The scales of *P. operculella* washed by acetone and chloroform and those of other species (*Cadra cautella* and *Chilo suppressalis*) were also used as covering of paper models. Powdered scales or the scales kneaded with adhesive had no effect as a releaser for copulation attempt, while the scales washed by acetone and chloroform or those of two other species showed similar effect as untreated scales of *P. operculella*. Therefore, the induction of copulation attempt seemed to owe to a physical structure of scales rather than their chemical nature.

Concluding Remarks

Some workers have reported that scales played important roles in mating behavior of lepidopterous insects by means of light reflection⁴⁾, or by release of some chemicals⁵⁾. Also, Hidaka (1972)⁶⁾, working with mating behavior of *Hyphantria cunea*, suggested the importance of contact-chemical inspection with antennae as the final step of species recognition. Result obtained from this experiment strongly suggest that the contact with scales is one of the releasers for the evocation of copulation attempt at least in male *P. operculella*.

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抄 録

ワタアカミムシの性誘引物質

The Pink Bollworm Sex Attractant: B. A. Bierl, M. Beroza, R. T. Staten, P. E. Sonnet, V. E. Adler, *J. Econ. Entomol.*, 67 (2) 211 (1974).

ワタアカミムシの性フェロモンをEAG法を指標として検討し、Hummelらの結果を再確認した。すなわち雌抽出物をケン化、アセチル化後クロマトグラフ法で精製し、性フェロモン75 μ gを得た。水素化分解、

オゾン分解および質量分析の結果から、7,11-hexadecadien-1-olと決定した。合成4幾何異性体と天然化合物のガスクロマトグラフ法分析の結果、フェロモンはZ, E-およびZ, Z-異性体の等量混合物と判明した。4幾何異性体を単独および種々の組合わせについて野外試験した結果、Z, E-とZ, Z-異性体の等量混合物が最も強い誘引性を示した。

(桑原保正)